



WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2005AZ81B

Title: Treatment of Nitrate in Groundwater with Autotrophic Bioreactors

Project Type: Research

Focus Categories: Nitrate Contamination, Treatment, Water Quality

Keywords: denitrification, elemental sulfur, biofilter

Start Date: 03/01/2005

End Date: 02/28/2006

Federal Funds: \$10,000

Non-Federal Matching Funds: \$20,000

Congressional District: 7

Principal Investigators:

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Abstract

Nitrate contamination of groundwater in Arizona is a serious problem. In certain regions such as the West Salt River Valley, 78% of the wells contain nitrate levels in excess of the U.S. EPA MCL for nitrate. As population centers of the state grow, groundwater contaminated with nitrate will need to be utilized for the preparation of potable water. Biological treatment of nitrate in drinking water is an attractive alternative since it does not generate problematic waste brines. Instead nitrates are converted by a four step enzymatic process known as denitrification to benign dinitrogen gas (N₂). Denitrification requires an electron donor, which typically is an organic substrate. For drinking water purposes, inorganic electron donors supporting chemolithoautotrophic denitrification are preferred so as to prevent residual organics from entering the treatment train. The goal of this research is to evaluate the feasibility of a low cost, low maintenance packed-bed bioreactor utilizing insoluble elemental sulfur as the electron donor for denitrification. The research specifically evaluates the feasibility of improving process kinetics by using more bioavailable grades of elemental sulfur. Additionally, the project investigates the role of naturally occurring groundwater alkalinity in fulfilling neutralization and inorganic carbon requirements of the process. The outcome of the project will be a simple

design concept that can be utilized by small water utilities for the affordable and reliable treatment of nitrate in groundwater.